

**Question #168****Answer: C**

Complete the table:

$$l_{81} = l_{[80]} - d_{[80]} = 910$$

$$l_{82} = l_{[81]} - d_{[81]} = 830 \quad (\text{not really needed})$$

$$\dot{e}_x = e_x + \frac{1}{2} \quad \left( \frac{1}{2} \text{ since UDD} \right)$$

$$e_{[x]}^{\circ} = e_{[x]} + \frac{1}{2}$$

$$e_{[x]}^{\circ} = \left[ \frac{l_{81} + l_{82} + l_{83} + \dots}{l_{[80]}} \right] + \frac{1}{2}$$

$$\left[ \dot{e}_{[80]}^{\circ} - \frac{1}{2} \right] l_{[80]} = l_{81} + l_{82} + \dots \quad \text{Call this equation (A)}$$

$$\left[ \dot{e}_{[81]}^{\circ} - \frac{1}{2} \right] l_{[81]} = l_{82} + \dots \quad \text{Formula like (A), one age later. Call this (B)}$$

Subtract equation (B) from equation (A) to get

$$l_{81} = \left[ \dot{e}_{[80]}^{\circ} - \frac{1}{2} \right] l_{[80]} - \left[ \dot{e}_{[81]}^{\circ} - \frac{1}{2} \right] l_{[81]}$$

$$910 = [8.5 - 0.5]1000 - \left[ \dot{e}_{[81]}^{\circ} - 0.5 \right] 920$$

$$\dot{e}_{[81]}^{\circ} = \frac{8000 + 460 - 910}{920} = 8.21$$

Alternatively, and more straightforward,

$$p_{[80]} = \frac{910}{1000} = 0.91$$

$$p_{[81]} = \frac{830}{920} = 0.902$$

$$p_{81} = \frac{830}{910} = 0.912$$

$$\dot{e}_{[80]} = \frac{1}{2}q_{[80]} + p_{[80]}\left(1 + \dot{e}_{81}\right)$$

where  $q_{[80]}$  contributes  $\frac{1}{2}$  since UDD

$$8.5 = \frac{1}{2}(1 - 0.91) + (0.91)\left(1 + \dot{e}_{81}\right)$$

$$\dot{e}_{81} = 8.291$$

$$\dot{e}_{81} = \frac{1}{2}q_{81} + p_{81}\left(1 + \dot{e}_{82}\right)$$

$$8.291 = \frac{1}{2}(1 - 0.912) + 0.912\left(1 + \dot{e}_{82}\right)$$

$$\dot{e}_{82} = 8.043$$

$$\dot{e}_{[81]} = \frac{1}{2}q_{[81]} + p_{[81]}\left(1 + \dot{e}_{82}\right)$$

$$= \frac{1}{2}(1 - 0.902) + (0.902)(1 + 8.043)$$

$$= 8.206$$

Or, do all the recursions in terms of  $e$ , not  $\dot{e}$ , starting with  $e_{[80]} = 8.5 - 0.5 = 8.0$ , then

final step  $\dot{e}_{[81]} = e_{[81]} + 0.5$